aqueous condensation, unless you use one of the following configurations:

(1) Connect an NDUV downstream of any dryer or chiller that is downstream of an NO_2-to-NO converter that meets the verification in §1065.378.

(2) Connect an NDUV downstream of any dryer or thermal chiller that meets the verification in §1065.376.

O₂ MEASUREMENTS

§ 1065.280 Paramagnetic and magnetopneumatic O₂ detection analyzers.

(a) *Application.* You may use a paramagnetic detection (PMD) or magnetopneumatic detection MPD) analyzer to measure O_2 concentration in raw or diluted exhaust for batch or continuous sampling. You may use O_2 measurements with intake air or fuel flow measurements to calculate exhaust flow rate according to §1065.650.

(b) *Component requirements.* We recommend that you use a PMD/MPD analyzer that meets the specifications in Table 1 of §1065.205. Note that it must meet the linearity verification in §1065.307. You may use a PMD/MPD that has compensation algorithms that are functions of other gaseous measurements and the engine's known or assumed fuel properties. The target value for any compensation algorithm is 0.0% (that is, no bias high and no bias low), regardless of the uncompensated signal's bias.

AIR-TO-FUEL RATIO MEASUREMENTS

§ 1065.284 Zirconia (ZrO₂) analyzer.

(a) *Application.* You may use a zirconia (ZrO_2) analyzer to measure air-to-fuel ratio in raw exhaust for continuous sampling. You may use O_2 measurements with intake air or fuel flow measurements to calculate exhaust flow rate according to §1065.650.

(b) *Component requirements.* We recommend that you use a ZrO_2 analyzer that meets the specifications in Table 1 of §1065.205. Note that your ZrO_2-based system must meet the linearity verification in §1065.307. You may use a Zirconia analyzer that has compensation algorithms that are functions of other gaseous measurements and the engine's known or assumed fuel properties. The target value for any com-

pensation algorithm is 0.0% (that is, no bias high and no bias low), regardless of the uncompensated signal's bias.

PM MEASUREMENTS

§ 1065.290 PM gravimetric balance.

(a) *Application.* Use a balance to weigh net PM on a sample medium for laboratory testing.

(b) *Component requirements.* We recommend that you use a balance that meets the specifications in Table 1 of §1065.205. Note that your balance-based system must meet the linearity verification in §1065.307. If the balance uses internal calibration weights for routine spanning and linearity verifications, the calibration weights must meet the specifications in §1065.790. While you may also use an inertial balance to measure PM, as described in §1065.295, use a reference procedure based on a gravimetric balance for comparison with any proposed alternate measurement procedure under §1065.10.

(c) *Pan design.* We recommend that you use a balance pan designed to minimize corner loading of the balance, as follows:

(1) Use a pan that centers the PM sample on the weighing pan. For example, use a pan in the shape of a cross that has upswept tips that center the PM sample media on the pan.

(2) Use a pan that positions the PM sample as low as possible.

(d) *Balance configuration.* Configure the balance for optimum settling time and stability at your location.

§ 1065.295 PM inertial balance for field-testing analysis.

(a) *Application.* You may use an inertial balance to quantify net PM on a sample medium for field testing.

(b) *Component requirements.* We recommend that you use a balance that meets the specifications in Table 1 of §1065.205. Note that your balance-based system must meet the linearity verification in §1065.307. If the balance uses an internal calibration process for routine spanning and linearity verifications, the process must be NIST-traceable. You may use an inertial PM balance that has compensation algorithms that are functions of other

gaseous measurements and the engine's known or assumed fuel properties. The target value for any compensation algorithm is 0.0% (that is, no bias high and no bias low), regardless of the uncompensated signal's bias.

Subpart D—Calibrations and Verifications

§ 1065.301 Overview and general provisions.

(a) This subpart describes required and recommended calibrations and verifications of measurement systems. See subpart C of this part for specifications that apply to individual instruments.

(b) You must generally use complete measurement systems when performing calibrations or verifications in this subpart. For example, this would generally involve evaluating instruments based on values recorded with the complete system you use for recording test data, including analog-to-digital converters. For some calibrations and

verifications, we may specify that you disconnect part of the measurement system to introduce a simulated signal.

(c) If we do not specify a calibration or verification for a portion of a measurement system, calibrate that portion of your system and verify its performance at a frequency consistent with any recommendations from the measurement-system manufacturer, consistent with good engineering judgment.

(d) Use NIST-traceable standards to the tolerances we specify for calibrations and verifications. Where we specify the need to use NIST-traceable standards, you may alternatively ask for our approval to use international standards that are not NIST-traceable.

§ 1065.303 Summary of required calibration and verifications.

The following table summarizes the required and recommended calibrations and verifications described in this subpart and indicates when these have to be performed:

TABLE 1 OF § 1065.303—SUMMARY OF REQUIRED CALIBRATION AND VERIFICATIONS

Type of calibration or verification	Minimum frequency [a]
§ 1065.305: accuracy, repeatability and noise.	*Accuracy:* Not required, but recommended for initial installation. *Repeatability:* Not required, but recommended for initial installation. *Noise:* Not required, but recommended for initial installation.
§ 1065.307: linearity	*Speed:* Upon initial installation, within 370 days before testing and after major maintenance. *Torque:* Upon initial installation, within 370 days before testing and after major maintenance. *Electrical power:* Upon initial installation, within 370 days before testing and after major maintenance. *Clean gas and diluted exhaust flows:* Upon initial installation, within 370 days before testing and after major maintenance, unless flow is verified by propane check or by carbon or oxygen balance. *Raw exhaust flow:* Upon initial installation, within 185 days before testing and after major maintenance, unless flow is verified by propane check or by carbon or oxygen balance. *Gas analyzers:* Upon initial installation, within 35 days before testing and after major maintenance. *PM balance:* Upon initial installation, within 370 days before testing and after major maintenance. *Stand-alone pressure and temperature:* Upon initial installation, within 370 days before testing and after major maintenance.
§ 1065.308: Continuous analyzer system response and recording.	Upon initial installation, after system reconfiguration, and after major maintenance.
§ 1065.309: Continuous analyzer uniform response.	Upon initial installation, after system reconfiguration, and after major maintenance.
§ 1065.310: torque	Upon initial installation and after major maintenance.
§ 1065.315: pressure, temperature, dewpoint.	Upon initial installation and after major maintenance.
§ 1065.320: fuel flow	Upon initial installation and after major maintenance.
§ 1065.325: intake flow	Upon initial installation and after major maintenance.
§ 1065.330: exhaust flow	Upon initial installation and after major maintenance.
§ 1065.340: diluted exhaust flow (CVS)	Upon initial installation and after major maintenance.
§ 1065.341: CVS and batch sampler verification.	Upon initial installation, within 35 days before testing, and after major maintenance.
§ 1065.345: vacuum leak	Before each laboratory test according to subpart F of this part and before each field test according to subpart J of this part.